

## FEATURES

- Provides Complete AppleTalk DCE Interface
- Supports Direct Connect or LocalTalk®
- Transmit Enable Controls Three-State Driver Outputs
- Flow-Through Architecture for Easy PC Layout
- Rugged Bipolar Design
- Thermal Shutdown Protection
- Outputs Assume a High Impedance State when Off or Powered Down
- Short-Circuit Protection on All Outputs

## APPLICATIONS

- Printers
- Modems
- Local Area Networks


## DESCRIPTION

The LT<sup>®</sup>1389 is a complete AppleTalk DCE interface transceiver. The circuit includes one differential driver, one differential receiver, two high speed single-ended drivers and one RS232/RS562 receiver. Logic inputs provide driver and receiver three-state modes and a low power shutdown control. The differential driver may be used as an additional single-ended driver, supporting RS562 output levels.

The high speed single-ended driver and differential driver support data clock rates to 1Mbaud, allowing direct connect operation with all Macintosh peripheral devices.

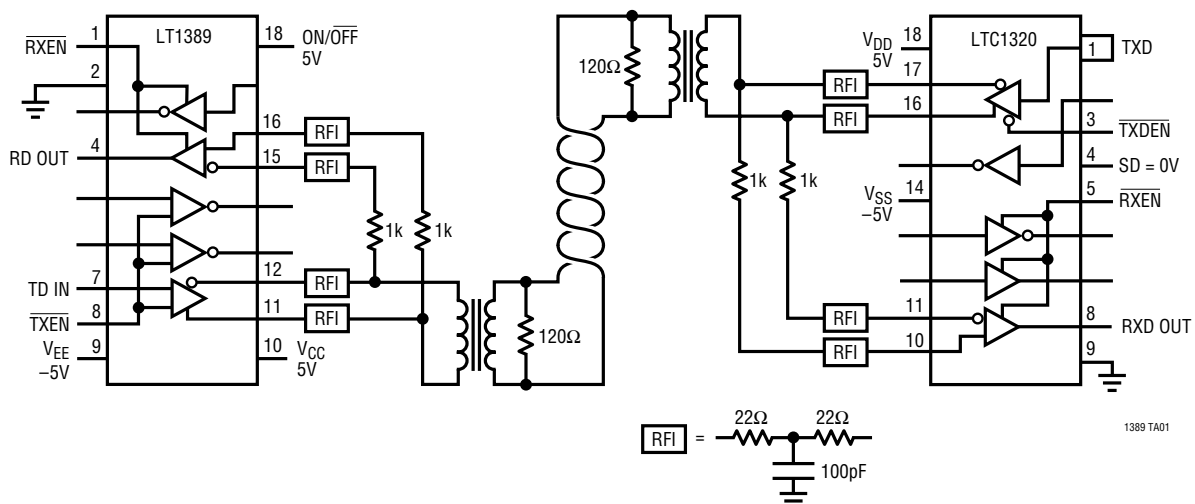
The Transmit and Receive Enable controls provide flexible operating mode control for sharing data lines between multiple circuits.

The LT1389 is available in 18-lead PDIP and SO Wide packages.

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## TYPICAL APPLICATION

Typical LocalTalk Application

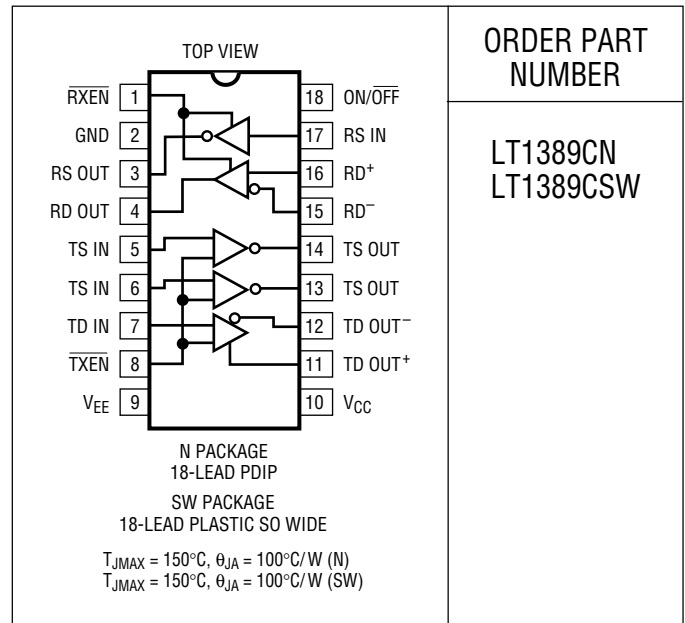


**ABSOLUTE MAXIMUM RATINGS**

(Note 1)

Supply Voltage	
$V_{CC}$ .....	6V
$V_{EE}$ .....	-6V
Input Voltage	
Driver .....	-0.2V to 6V
TXEN, RXEN, ON/OFF .....	-0.2V to 6V
Single-Ended Receiver .....	-30V to 30V
Differential Receiver .....	-7V to 12V
Output Voltage	
Driver .....	-30V to $V_{CC} + 12V$
Receiver .....	-0.3V to $V_{CC} + 0.3V$
Short-Circuit Duration	
Driver Output .....	Indefinite
Receiver Output .....	Indefinite
Operating Temperature Range .....	0°C to 70°C
Storage Temperature Range .....	-65°C to 150°C
Lead Temperature (Soldering, 10 sec) .....	300°C

**PACKAGE/ORDER INFORMATION**



ORDER PART NUMBER

LT1389CN  
LT1389CSW

Consult factory for Industrial and Military grade parts.

**ELECTRICAL CHARACTERISTICS** 0°C ≤ TA ≤ 70°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	$V_{CC}$ $V_{EE}$	$V_{ON/OFF} = 5V$	8	15	mA
			3	5	mA
Supply Current in Shutdown	$V_{CC}$ $V_{EE}$	$V_{ON/OFF} = 0V$		10	μA
				10	μA
Logic Input Thresholds (TXEN, ON/OFF, TS IN, TD IN)	Input Low Level Input High Level	0.8	1.4		V
			1.4	2.0	V
<b>Differential/Single-Ended Driver</b>					
Differential Output Voltage, $V_{OD}$	No Load (Figure 1) $R_L = 100\Omega$ $R_L = 50\Omega$	7	8	10	V
		2	3		V
		1.5	3		V
Output Common-Mode Voltage, $V_{OC}$	$R_L = 100\Omega$ (Figure 1)	2.0		3.0	V
Single-Ended Output Voltage	Output High, $R_L = 3k$ (Figure 2) Output Low, $R_L = 3k$	3.7	4.2		V
			-4.0	-3.7	V
Input Current	$0V \leq V_{IN} \leq 5V$	-10		10	μA
Output Leakage Current	$V_{TXEN} = 2V, -5V \leq V_{OUT} \leq 5V$	-100		100	μA
Output Short-Circuit Current	$I_{SC}^+$ $I_{SC}^-, V_{OUT} = 5V$ $I_{SC}^-, V_{OUT} = 0V$	35	150		mA
		-200		-35	mA
		-20		-8	mA
Differential Mode Propagation Delay	$R_L = 100\Omega$		40	75	ns
Driver Disable Delay			40	75	ns
Driver Enable Delay			40	75	ns
Single-Ended Output Fall Time	$R_L = 3k, C_L = 2500pF, V_{OUT} = 3V$ to $-3V$		1	2	μs
Single-Ended Output Rise Time	$R_L = 3k, C_L = 2500pF, V_{OUT} = -3V$ to $3V$		1	2	μs

## ELECTRICAL CHARACTERISTICS $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Differential Receiver</b>					
Differential Input Voltage Thresholds	$-7\text{V} \leq V_{\text{CM}} \leq 12\text{V}$	-0.2		0.2	V
Receiver Input Hysteresis	$-7\text{V} \leq V_{\text{CM}} \leq 12\text{V}$		70		mV
Input Resistance		12			k $\Omega$
Input Common-Mode Voltage		-7		12	V
Output Voltage	Output High, $I_{\text{OUT}} = 160\mu\text{A}$ Output Low, $I_{\text{OUT}} = -1.6\text{mA}$	2.4	4.0	0.4	V
Output Short-Circuit Current	Sinking Current, $V_{\text{OUT}} = V_{\text{CC}}$ Sourcing Current, $V_{\text{OUT}} = 0\text{V}$	-20	-10	20	mA
Propagation Delay			40	70	ns
<b>Single-Ended Receiver</b>					
Input Voltage Threshold	Input Low Threshold Input High Threshold	0.8	1.3 1.7	2.4	V V
Hysteresis		0.1	0.4	1.0	V
Input Resistance	$-5\text{V} \leq V_{\text{IN}} \leq 5\text{V}$	3	5	7	k $\Omega$
Output Voltage	Output Low, $I_{\text{OUT}} = -1.6\text{mA}$ Output High, $I_{\text{OUT}} = 160\text{mA}$ ( $V_{\text{CC}} = 5\text{V}$ )	3.5	0.2 4.2	0.4	V V
Output Short-Circuit Current	Sinking Current, $V_{\text{OUT}} = V_{\text{CC}}$ Sourcing Current, $V_{\text{OUT}} = 0\text{V}$	-20	-10 10	20	mA mA
Propagation Delay	Output Transition High to Low, $t_{\text{HL}}$ Output Transition Low to High, $t_{\text{LH}}$		250 350	600 600	ns ns
<b>Single-Ended Drivers</b>					
Output Voltage	Output High, $R_L = 3\text{k}$ Output Low, $R_L = 3\text{k}$	3.7	4.0 -4.4	-3.7	V V
Logic Input Current		-10		10	$\mu\text{A}$
Output Leakage Current	Shutdown or Driver Disable Modes	-100		100	$\mu\text{A}$
Output Short-Circuit Current	Sinking Current, $V_{\text{OUT}} = 0\text{V}$ Sourcing Current, $V_{\text{OUT}} = 0\text{V}$	-40	-10 50		mA mA
Slew Rate		60	100		V/ $\mu\text{s}$
Propagation Delay			60	100	ns
Driver Disable Delay			40	75	ns
Driver Enable Delay			60	100	ns

**Note 1:** Absolute maximum ratings are those values beyond which the life of the device may be impaired.

**Note 2:** Unless otherwise specified, testing done at  $V_{\text{CC}} = 5\text{V}$ ,  $V_{\text{EE}} = -5\text{V}$  and  $V_{\text{TXEN}} = 0\text{V}$ . Outputs and single-ended receiver inputs are open. Driver inputs are tied to  $V_{\text{CC}}$ . Differential receiver input  $\text{RD}^-$  is biased at 2.6V,  $\text{RD}^+$  at 2.4V.

**Note 3:** For driver delay measurements,  $R_L = 3\text{k}$  and  $C_L = 51\text{pF}$ . Trigger points are set between the driver's input logic threshold and the output transition to the zero crossing. ( $t_{\text{HL}} = t_{\text{LH}} = 1.4\text{V}$  to  $0\text{V}$ )

**Note 4:** For receiver delay measurements,  $C_L = 51\text{pF}$ . Trigger points are set between the receiver's input logic threshold and the output transition to standard TTL/CMOS logic threshold. ( $t_{\text{HL}} = 1.3\text{V}$  to  $2.4\text{V}$  and  $t_{\text{LH}} = 1.7\text{V}$  to  $0.8\text{V}$ )

## PIN FUNCTIONS

**RXEN (Pin 1):** Receiver Enable Control. An open pin or a logic low allows normal operation of the receivers. A logic high causes receiver outputs to become high impedance, allowing sharing of the receiver output data lines.

**GND (Pin 2):** Ground Pin.

**RS OUT (Pin 3):** Single-Ended Receiver Output with TTL/CMOS Voltage Levels. The output is fully short-circuit protected to GND or  $V_{\text{CC}}$ .

## PIN FUNCTIONS

**RD OUT (Pin 4):** Differential Receiver Output Pin with TTL/CMOS Voltage Levels. The output is fully short-circuit protected to GND or  $V_{CC}$ .

**TS IN (Pins 5, 6):** Single-Ended Driver Input Pins. These inputs are TTL/CMOS compatible. An input logic low causes a driver output high. Tie unused inputs to GND.

**TD IN (Pin 7):** Differential Driver Input Pin. A TTL/CMOS compatible logic input. A logic high causes driver output  $RD^+$  to swing high and  $RD^-$  low. Tie input to  $V_{CC}$  when not in use.

**$\overline{TXEN}$  (Pin 8):** A TTL/CMOS logic high places the driver outputs into a high impedance state. A logic low fully enables the transmit capabilities. Transitions occur at data rate speeds to facilitate data line multiplexing.

**$V_{EE}$  (Pin 9):**  $-5V$  Input Supply Pin. This pin should be decoupled with a  $0.1\mu F$  ceramic capacitor.

**$V_{CC}$  (Pin 10):**  $5V$  Input Supply Pin. This pin should be decoupled with a  $0.1\mu F$  ceramic capacitor.

**TD OUT<sup>+</sup>, TD OUT<sup>-</sup> (Pins 11, 12):** Differential Driver Output Pins. Outputs drive  $100\Omega$  differential loads to RS422 levels, and are also capable of supplying RS562 levels to single-ended loads greater than  $3k\Omega$ . Outputs are

in a high impedance state when  $\overline{TXEN}$  is high or  $V_{CC} = 0V$ . Outputs are fully short-circuit protected from  $V_{OUT} = V_{EE} + 20V$  to  $V_{OUT} = V_{CC} - 20V$ . Applying higher voltages will not damage the device if the overdrive is moderately current limited.

**TS OUT (Pins 13, 14):** Single-Ended Driver Outputs at RS562 Voltage Levels. Outputs are in a high impedance state when  $\overline{TXEN}$  is high or  $V_{CC} = 0V$ . Outputs are fully short-circuit protected from  $V_{OUT} = V_{EE} + 20V$  to  $V_{OUT} = V_{CC} - 20V$ . Applying higher voltage will not damage the device if the overdrive is moderately current limited.

**$RD^-$ ,  $RD^+$  (Pins 15, 16):** Differential Receiver Input Pins. Common-mode input range is  $-7V$  to  $12V$ . Receiver inputs have  $50mV$  of hysteresis for noise immunity.

**RS IN (Pin 17):** Single-Ended Receiver Input. This pin accepts RS232 or RS562 level signals ( $\pm 30V$ ) into a protected  $5k$  terminating resistor. The receiver input provides  $0.4V$  of hysteresis for noise immunity. Data rates to  $120kbaud$  are supported.

**ON/OFF (Pin 18):** A logic low level on this pin shuts down the circuit. All receiver and driver outputs are high impedance. A logic high allows normal operation of the circuit.

## TEST CIRCUITS

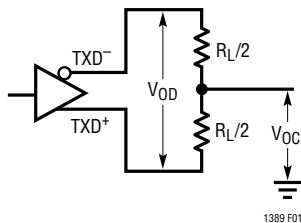


Figure 1. Differential Output Test Circuit

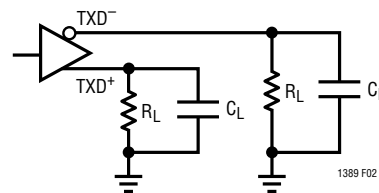


Figure 2. Single-Ended Output Test Circuit

## RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC1320	Appletalk Transceiver	Complete DTE Port
LTC1334	RS232/RS485 Multi-Protocol Transceiver	Appletalk Compatible
LTC1337	5V 3-Driver/5-Receiver Micropower RS232 Transceiver	500 $\mu A$ Quiescent Current
LTC1345	V.35 Differential Transceiver	Low Power V.35 Solution
LTC1348	3.3V 3-Driver/5-Receiver RS232 Transceiver	True RS232 from 3.3V Supplies